Adaptation process of farming systems in response to 14 successive years of drought in North West Coastal Zone (Egypt)

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Abstract

The Coastal Zone of Western Desert, Egypt (CZWD) is historically a pastoral zone, and the raising of livestock is the main socioeconomic activity. The zone has witnessed major changes over the last 50 years; demographic growth, urbanization, touristic development and agro-ecological diversification. More recently, the zone has faced a long drought period from 1995 to 2011, with low erratic rainfall (< 150 mm). Scarcity of rainfall has affected farming systems and household livelihood. The Bedouin societies have diversified their farming systems, based on livestock, barley and fruit trees.

The study analyzes the impacts of this long drought period on the livestock farming systems, and the adaptive processes developed by breeders to cope with it. The analysis is based on household surveys (182 families surveyed between April and July 2011) in three agro-climatic regions of the CZWD: the rainfed region (West), the new reclaimed lands (East) and Siwa desert Oasis.

The role of small ruminants differs accordingly to the agro-ecological region. In the dry rainfed region (West), flock size decreased from 244 to 152 heads, over the drought period from 1995 to 2011, where it is increase from 161 to 234 in the new reclaimed lands (East), with the availability of green fodder and crop residuals. The animal reproductive performance as lamb born/ewe/year differs with the agro-ecological region being better in the new reclaimed lands. In the rainfed region, breeders have developed different adaptive mechanisms such as, decreasing flock size, raising more goats, relying more on concentrate feeding and early marketing of their lambs/kids. Migration of family members to agro-pastoral and urban areas was another social coping mechanism to the long drought. Long drought duration have induced detectable diversification of farming activities in the area.

Introduction and background

The present study was carried as a collaborative research between the Animal Production Research Institute (APRI), the Ministry of Agriculture and the International Centre of agricultural research for development (CIRAD), to study the role of livestock activities in the process of adaptation and reducing the vulnerability of Mediterranean societies facing global climatic changes. The present study aimed to study the effect of the long drought period in the Coastal Zone of Western Desert. The climate ranges from Mediterranean in the North to arid in the South. It is a hot dry zone with low erratic rainfall (< 150 mm/yr) during last fifteen years (Aboul-Naga et al., 2008). Temperatures reach 39°C in July and August and 5°C in January; it reached zero point in some winter days. Raining season starts from mid October to mid March.

Small ruminants, with different production systems, represent the main activity in the studied regions for family income and nutrient requirements (milk and meat). The study aimed to

analyze different adaptive processes practiced by the breeders at different agro ecological regions to face the prolonged drought period from 1995-2011.

Materials and Methods

The study area extends from Alexandria East to the Libyan border West for about 500 km. A field survey was implemented in 2011 (from April to July) for 182 breeders distributed all over the area from Borg-Arab East to Sidi Barani West. The studied area consisted of three agro-ecological regions: (i) the new reclaimed lands in the East, from Borg-Arab to Hammam (40-60 km to Alexandria), (ii) the rainfed region in the West, from Dabaa to Sidi Barani (140–430 km to Alexandria) (Fig 1 & Table 1). The areas in between are mainly mine fields from World War II, with limited livestock activities. The last region is Siwa Oasis, located in the Western Desert near the Libyan border, 550 km west of Cairo and 350 km from Matrouh city.

Lately, the eastern region has known a major agrarian change with the establishment of irrigated canal from the Nile. In these New Reclaimed lands, the cropping system is based on green fodder (mainly Egyptian clover in winter or maize in summer), cereal (mainly wheat in winter) and vegetables in summer. In Siwa desert oasis, where rainfall is negligible, farmers depend for their water resources on springs and ground water. The lack of drainage system there, results in soil salinity problems. Alfalfa is the main green fodder plus stubbles and vegetable and fruits residuals. Animals are raised mainly in household system.

The field survey was based on a technical and socio-economic questionnaire which comprises 5 main components:

- Family structure, housing and off farm activities;
- Land and cropping system;
- Livestock structure, range status, grazing practices, feeding and management
- Animal performance and marketing
- Constraints and perception of climatic changes

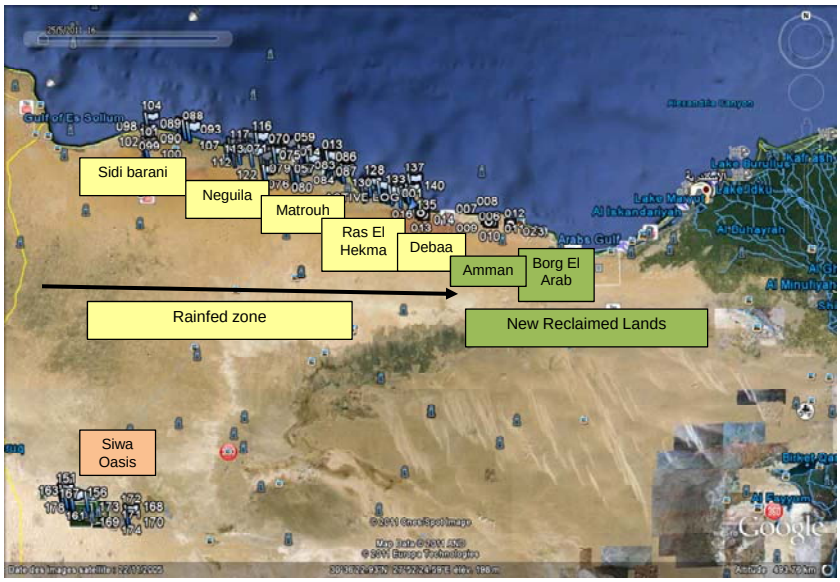

Fig.1 Location of the 182 farms surveyed in the Coastal Zone of Western Desert in Egypt (CZWD).

Table 1. Number of breeders studied in the East, West and Siwa regions.

Region	No. of breeders
New reclaimed land (East):	
Borg-Arab	21
Hammam	7
Total	**28**
Rainfed area (West):	
Dabaa	29
Ras El-Hekma	20
Matrouh	40
Neguila	17
Sidi barani	18
Total	**124**
Desert Oasis:	
Siwa	**30**
Total	**182**

The different adaptive processes in response to the prolonged drought period are analyzed through the livestock farming systems as declared by the breeders in the questionnaire mainly; adjustment of flock size, feed system and marketing strategy.

Results and discussion

Facing long drought period, the breeders of CZWD have developed different mechanisms to cope with the situation. These mechanisms differ according the agro-climatic regions and available capabilities. These mechanisms combine different strategies based on flock type, feeding system, flock size and marketing strategy over the last year 2010-2011.

Flock type

Flocks in the West region are normally mixed of both sheep and goats. Few flocks have either sheep or goats (11% and 2%, respectively). Twenty percent of the breeders in Siwa Oasis raise only goats where the rest raises mixed sheep and goat flocks. The breeders had raised more goats with their sheep flocks as a long procedure to give more flexibility in coping with the long incidence of regular drought, immediate no change had been observed over the last year. The situation differs in the East with the availability of green fodder. Now, 39% of the breeders there raise only sheep.

Feeding system

Grazing on natural ranges in the CZWD used to extend from 3-5 months during the seventies and eighties (Aboul-Naga et al., 1985). These natural ranges were estimated to cover around 30% of the feed requirements in the zone before the last drought. Including cereals and their residuals, the rainfed region met about 45% of the animal stocks requirements (Galal et al., 2005). The present study showed that natural ranges now cover lower percentages of the stocks requirements. Grazing months has been reduced to 3.27 months, with a range between 0.25 and 4 months (Table 2). The breeders move with their flocks over large areas (up to 200 km). This is become a dominant feature of the area. Consequently the breeders rely on concentrates for animal feeding for more than 8 months per year. The unit cost of feeding has been multiplied, with the high increase of the prices of the imported concentrates (mainly maize and wheat) since 2008. With the poor range conditions during the studied drought period, some breeders had to provide supplementary feeding during the grazing

period (0.89 kg/head in average) (Table 3). More seriously, 31% of the flocks in the rainfed region had zero grazing and got to fed concentrates all the year around, plus available roughages (mainly wheat and barley straw). The eastern region and Siwa Oasis were better off, with the availability of green fodder, Alfalfa and crop residues for 7.7 and 5.9 months in the two regions, respectively.

Table 2. Grazing performance.

Regions		Grazing flocks				
		Grazing period (mo)			Distance from pasture (km)	
	Total No of breeders	No of breeders (%)	Average	Range	Average	Range
Rainfed area (natural ranges)	124	85(69)	3.27	0.25 - 4	13.62	0.2 - 200
New reclaimed lands (green fodder & crop residual)	28	23(82)	7.67	1 - 12	12.45	0.5 - 75
Siwa Oasis (Alfalfa & crop residual)	30	21(70)	5.90	1.5 - 11	29.00	1 - 70

Table 3. Supplementary feeding (SF) for grazing flocks.

Region	No of breeders using SF during grazing	SF during grazing (kg/head/day)	No of breeders using SF out of grazing	SF out of grazing (kg/head/day
Rainfed area	19	0,89	85	1,057
New reclaimed lands	11	0,55	23	0,875
Siwa Oasis	8	0,61	21	0,876
Total	38	0,68	129	0,936

Flock size

The results in Table (4) indicate that flock size in the West decreased by more than 38% over the last 14 years. Most of the breeders maintained the productive females as much as they can. But with the long drought period, the breeders had to sell mature females and therefore reduce their live capital. On the opposite, the flock size has increased in the eastern region and Siwa Oasis by nearly 45% and 12%, respectively, over the same period (1995 – 2011).

Decreasing the flock size in the West, has been a major adaptive process of the breeders to cope with the long drought conditions and degraded range lands. Some breeders moved with their flocks nearby Nile Valley, and rent grazing lands of Egyptian clover and crop residuals. In the East region, increasing the flock size has depended on the availability of green fodder and crop residuals, from both small and large ruminants. In the East, the flock average 234 heads, from both sheep and goat, beside 3.03 heads of cattle (Table 4).

Table 4. Flock size development and performance indicators.

Regions	Flock size	Difference from 1995 (%)	Ewe lambs	Mature ewes	Lambs born/ewe/year	Lamb mortality (%)
Rainfed area	152	-37,7	23	75	1.00	11.37
New reclaimed lands	234	45,3	31	155	1.05	16.07
Siwa Oasis	65	12,1	6	25	1.12	22.44

In Siwa Oasis, the availability water from springs and wells and the developing of agrarian system has led to increase the small ruminant flocks, by 12%. Some heads of LR are also raised (3.00 heads in average).

As expected, the reproductive performances of sheep, as number of lambs born/ewe mated, were lower in the western region than in the eastern region (Table 4). The high lamb loss in Siwa oasis is due to lack of veterinarian services.

Marketing strategy

One of the actions taken by the breeders in the rainfed area to address the long drought period was selling their lambs and kids directly after weaning (58% of the breeders). Some breeders (12%) have to sell some dams with their kids to buy concentrates to feed the rest of the flock. Some breeders kept their lambs after weaning, practicing early fattening for 2-3 months (34% of the breeders) and sold them at 6 months of age. The breeders in Siwa oasis have followed similar strategies of selling their lambs after weaning or after short fattening (Table 5). In the new reclaimed lands (East), the breeders seem to have more choices between early fattening of their lambs (32%) and late fattening (29%) in response to the market need. Many of them mix the two marketing strategies.

Table 5 Marketing strategy.

Region (number of breeders)	Selling Weaning lambs		Early fattening		Late fattening		Selling dams with their kids	
	# breeders (%)	# Lambs	# breeders (%)	# Lambs	# breeders (%)	# Lambs	# breeders (%)	# animals
Rainfed area (124)	72(58%)	48	42(34%)	35	10(8%)	91	15(12%)	16
New reclaimed lands (28)	11(39%)	59	9(32%)	157	8(29%)	103	3(11%)	17
Siwa Oasis (30)	21(70%)	11	7(23%)	47	2(7%)	2	7(25%)	11

Conclusions

The findings of the present study indicated that the climatic changes over the last 14 years in the region, with low erratic rainfall of <150 mm only, has led to a deterioration of natural ranges. Natural ranges have been able to cover only around 25% of the feed requirement of animals, compared to almost 45% in the eighties. One third of the flocks in the rainfed region have known zero grazing. The breeders had to rely on concentrates for feeding their animals. Decreasing flock size was a major process of the breeders to cope with the long drought conditions and degraded range lands in the rainfed region. Breeders had to sale some productive females, sometimes with their kids. Flock size decreased by more than 38% in the rainfed area. Raising more goats with their flocks was practiced to give more flexibility for the breeders in coping with the long incidence of drought in the rainfed region. In the market, they need to sell their lambs and kids directly after weaning or after short fattening of 2-3 months.

These results reflect well the vulnerability of breeders according to agro-climatic conditions. Seventy five percent of the breeders in the rainfed area reported that the drought was the major constraint over the last 14 years vs. 14% of the breeders in the new reclaimed lands, and Siwa Oasis with the availability of another source of water rather than rains. La Rovere and Aw-Hassan (2005) had reported that Bedouins in Syria in the rainfed area, who depended solely on livestock production in their livelihood, are highly vulnerable to the unreliable rainfall and degraded rangelands.

These different mechanisms may have important impacts on the future of the livestock activities in the rainfed area. If breeders showed that they continue to rely on grazing lands for raising animals when climatic conditions are good, the migration to the East region constitute now new opportunities and new models of livestock rising.

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